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PLUTELLAXYLOSTELLA- A NEW CHALLENGE FOR RAPESEED CULTURE

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ABSTRACT

Diamondblack moth (Plutellaxylostella) although a pest specific to the cabbage culture in the autumn of 2020 in the SE part of the Boianului Plain has proven to be the biggest challenge for rapeseed growers. To control the larvae of this species, six treatment variants were tested, five chemicals belonging to three chemical groups with different modes of action and a biological insecticide. Following the treatments, the mortality rate varied between 1.21% in the case of cypermethrin and 71.75% in the case of the use of the biological insecticide based on Bacillus thuringiensis subspkurstaki.

INTRODUCTION

Cabbage moth (Diamondblack moth, or Plutellaxylostella) is a globally distributed species that causes great economic damage.

The absence of natural enemies and the adaptability to different plants such as rapeseed, mustard, cabbage, cauliflower, broccoli are the major cause of the worldwide presence of this species **(Telekar, 1993).**

Regarding control, the most used method is the chemical one, but precisely due to its widespread use and for a very long period of time, this species began to develop an increased resistance to insecticides.

Research conducted in 2013-2014 in central China has shown that it is highly resistant to beta-cypermethrin and chlorfluazuron and medium resistance to insecticides based on chlorantraniliprol, spinosad, indoxacarb and abamectin **(Shuzhen, 2016).**

Due to the very high genetic variability **(Garcia et al. 2006),** the large number of annual generations **(Ulmer et al. 2002)** facilitates the development of insecticide resistance.

In Romania, the reduction of Plutellaxylostellapopulations by up to 80-90% occurs due to the presence of 14 species of primary parasitoids and the 14 identified secondary parasitoids can control 23.20% of pollulations**(Mustata, 2006).**

MATERIAL AND METHOD

In the context in which we know that this species is very resistant to many insecticidal chemicals through the present study, we aim to find the most effective treatment scheme that can be used by agricultural producers in the activity of combating this pest, using the more common chemicals used to control rapeseed-specific pests.

The experience was embedded in Radomiresti commune, Olt county according to the method of randomized blocks with seven experimental variants in three repetitions.

The following variants were tested:

- **V1**- Deltametrin 7.5 g s.a./ha
- **V2**- Cipermetrin 25 g s.a./ha

- **V3**- Acetamiprid 30 g s.a./ha
- **V4**- Tiacloprid 48 gs.a./ha
- **V5**- Clorantraniliprol 25 g s.a./ha
- **V6**- Bacillusthuringiensissubspkurstakitulpina ABTS 351 270 gs.a./ha
- **V7**- Martor(without treatment)

RESULTS AND DISCUSSIONS

Cabbage moth (Plutellaxylostella) is part of the category of the most studied pests in the world being very difficult to control, in Romania for the rapeseed culture it is considered to be a a secondary pest causing great damage to the cabbage culture**(https://www.cabi.org/isc/datasheet/42318)(Georgescu, 2016).**

It presents three generations per year in the conditions of our country, the first generation developing in May-July, the second in July-August and the third and the one that poses problems to the rapeseed culture develops starting with August and continues until the following year.

Following the treatment, the mortality rate was calculated.

The mortality rate was calculated using the Abbot formula:

%M=(PM/TP)*100 in which,
%M= mortality rate
PM= number of dead insects
TP= total number of insects

Wintering takes place in the stern stage in a cocoon pasted on the back of the attacked leaves. The adults of the new generation appear in May of the following year. The evolutionary cycle comprises four stages: egg, larva**,** stern **(figure 1)** and adult **(figure 3).** The duration of each stage is greatly influenced by temperature **(Rosca, 2003).**

The damaging stage is the larval stage. The larvae feed on the lower epidermis of the leaves after the attack, leaving holes of different sizes **(figure 4).** In cases of massive infestation they can destroy the entire photosynthetic apparatus leaving behind only the veins of the leaves **(figure 5).**

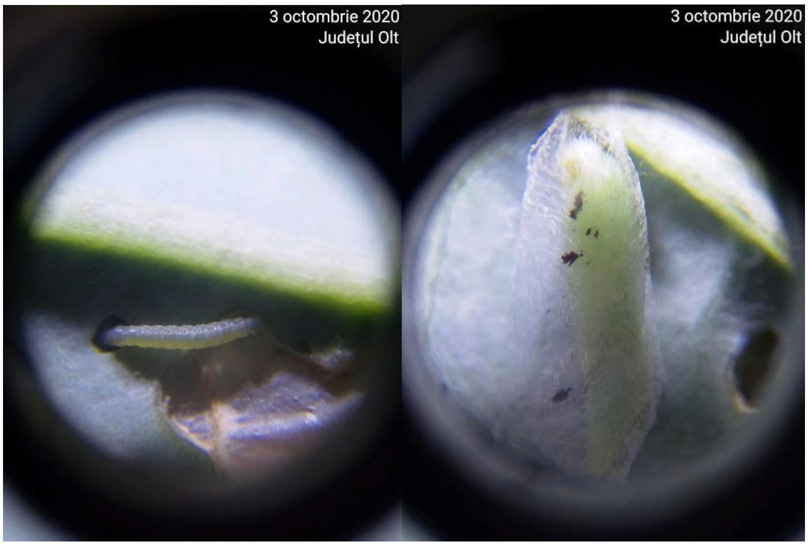

Figure 1: Larva Plutella xylostella(left) and pupa Plutella xylostella (right) original – 2020

Figure 3: Adult Plutella xylostella original – 2020

Figure 5: Attack produced by Plutella xylostella original – 2020

Figure 4: Cabbage leaf attack by Plutellaxilostella – original 2020

The analysis of the data contained in table 1 shows that following the treatments with various insecticidal chemicals, the average mortality rate of Plutellaxilostella larvae was between 1.21% and 71.75%.

In case of using the product whose active substance was deltamethrin at a dose of 7.5 g s.a./ha the average mortality rate was 2.89%.

Table 1

Calculated average mortality rate

No.	Variant	PM Number of dead insects	TP Total number of insects	%M Average mortality rate
1	**V1 (deltametrin 7.5 g s.a./ha)**	**10**	**345**	**2.89**
2	**V2 (cipermetrin 25 g s.a. /ha)**	**4**	**330**	**1.21**
3	**V3 (acetamiprid 30 g s.a./ha)**	**16**	**322**	**4.96**
4	**V4 (tiacloprid 48 g s.a./ha)**	**27**	**359**	**7.52**
5	**V5 (clorantraniliprol 25 g s.a./ha)**	**70**	**317**	**22.08**
6	**V6 (bacillusthuringiensissubsp. Kurstaki 270 g s.a./ha)**	**249**	**347**	**71.75**
7	**V7 (witness -without treatments)**	**0**	**326**	**0.00**

The second variant, in which an active substance from the category of synthetic pyrethroids was tested with insecticidal action of contact and non-systemic ingestion, the mortality rate was 1.21%, the substance used being cypermethrin.

In the third variant where acetamiprid was used in a dose of 30 g s.a./ha, the average mortality rate was 4.96%.

The number of dead insects in the fourth variant where thiacloprid was used in a dose of 48 g s.a./ha, is 27 out of a total of 359 and the average mortality rate resulting from the calculation is 7.52%.

Compared to the first four tested variants in which the average mortality rate did not exceed the 10% threshold, in the fifth tested variant where an active substance with a different mode of action was used compared to the other known insecticides, namely chlorantraniliprol in dose of 25 g sa / ha the average mortality rate was 22.08% with a number of 70 dead insects out of a total of 317 identified specimens.

In the sixth variant, a biological insecticide was tested with natural microorganisms, namely Bacillus thuringiensis subsp. Kurstaki in a dose of 270 g s.a./ha. In this case the mortality rate was 71.75%.

The seventh variant was left as a control and therefore the mortality rate is 0.00%.

Figure 6 shows that although a number of chemicals has been used to control pests of rapeseed culture, the best effective was the biological insecticide, due to the fact that it has not been used in the studied area for previous years and implicitly the pest did not develop resistance to this bacterium.

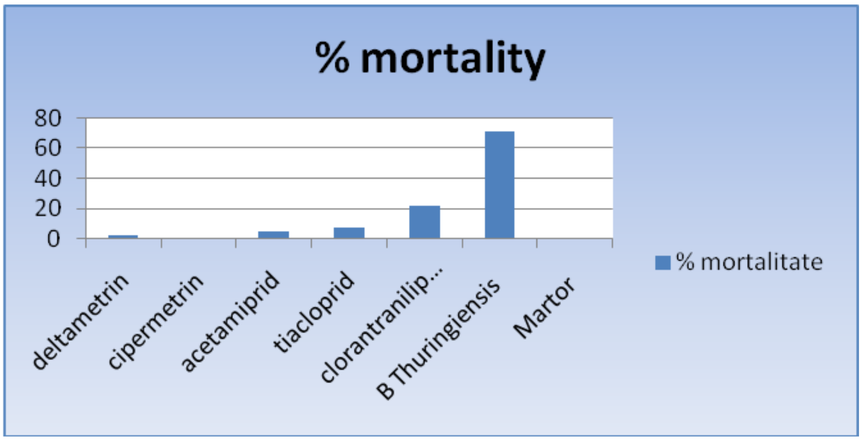

Figure 6: Average percentage of dead larvae (PlutellaXylostella species), calculated according to theused insecticide

Depending on the chemical group in which each insecticide is classified, their mode of action is different.

Deltamethrin and Cypermethrin are included in the category of synthetic pyrethroids acting on sodium channel modulators.

Thiacloprid and Acetamiprid in the Neonicotinoid group act on the nicotinic acetylcholine receptor (nAChr).

Chlorantraniliprol is in the Diamide group acting on rianodine receptor modulators.

Bacillus thuringiensis subsp. Kurstaki is classified as a biological insecticide and belongs to the category of microbial disruptors of insect midgut membranes.

As shown in **Figure 7**, depending on the mode of action of the active substance, the biological insecticide is followed by efficiency, followed by the active substance chlorantraniliprol, then the two substances in the Neonicotinoids group (acetamiprid and thiacloprid) and with reduced efficacy we have two active substances from category of synthetic pyrethroids (deltamethrin and cypermethrin).

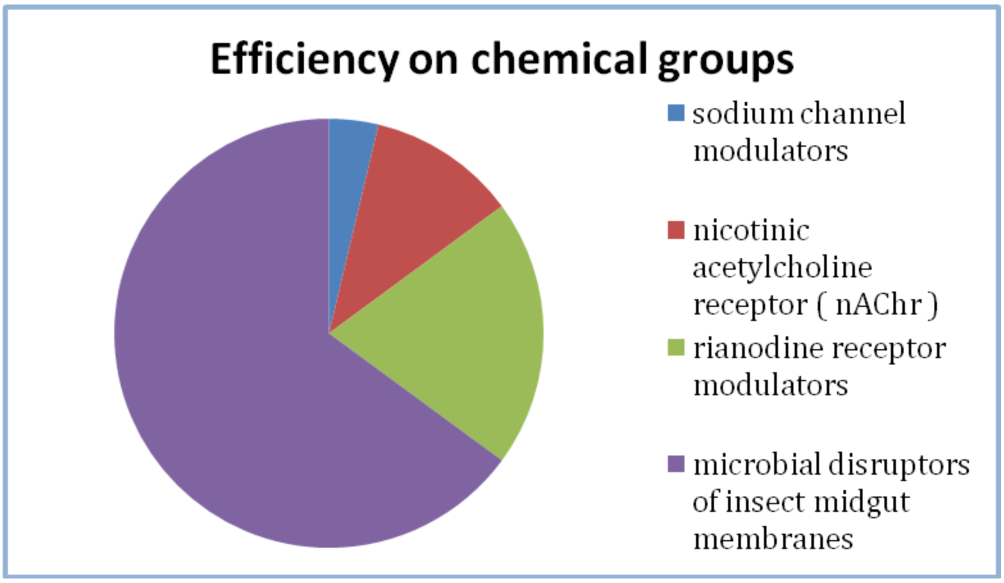

Figure 7: Mortality rate calculated according to the classification of insecticides by chemical groups

CONCLUSIONS

In the autumn of 2020, in the studied area, the pest Plutellaxilostella caused great problems for rapeseed growers due to the numerical density per unit area and the fact that it proved to be a species very resistant to the action of insecticides.

Six treatment variants were tested, five chemicals from three chemical groups with different modes of action and a biological incest based on natural microorganisms.

The best efficiency depending on the calculated mortality percentage was registered in the case of using the biological insecticide, this being 71.75%.

In case of using the biological insecticide due to its mode of action a great importance must be given to the quality of the treatment carried out in the sense that for a very good efficiency we recommend the best possible coverage with the spraying solution.

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